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EXAMINER	
RICHER, AARON M	

ART UNIT	PAPER NUMBER
2628	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/724,787	PALADINI, GIANLUCA	
	Examiner	**Art Unit**	
	AARON M. RICHER	2628	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _21 February 2008_.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-27_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-7,9,11-20,22 and 24-27_ is/are rejected.

7)☒ Claim(s) _8,10,21 and 23_ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

1. Applicant's arguments filed February 21, 2008 have been fully considered but they are not persuasive.

2. As to claim 1, applicant argues that Halmann does not use table values to identify ultrasound data where the display values are interpolated from the identified ultrasound data. Examiner notes that Halmann discloses the creation of scan conversion tables (col. 7, lines 54-57) and then performing scan conversion via interpolation (col. 8, line 53-col. 9, line 4). Since the scan conversion is converting the polar scanned data, which corresponds to ultrasound data (col. 7, lines 34-54), to display values, it is identifying the polar, or ultrasound, data as a function of the display, or Cartesian, values.

If one uses a lookup table, such as below, to perform a function:

A	B
1	2
2	4
3	6
4	8

then clearly one can identify the data of A as a function of the values of B, and vice versa.

3. As to claim 3, applicant argues that col. 8, lines 4-9 show scan and polar coordinate data not display coordinates. Examiner notes that scan converted data is in effect display coordinates, since scan conversion, by definition, converts a video signal into a format compatible with a display (see http://whatis.techtarget.com/definition/0,,sid9_gci1196642,00.html for instance). Applicant further argues that Halmann does not disclose inputting display coordinates into the lookup table. Examiner notes that Halmann discloses that the tables are scan conversion tables, i.e. used to scan convert the coordinate data, and thus input of the coordinates would be part of the scan conversion process.

4. As to claim 5, applicant argues that Halmann does not disclose display coordinates of interest input being coordinates of rays through the volume. Examiner notes that while the cited column 5 of Halmann does not explicitly disclose that the coordinates of rays through the volume are input to the lookup table, it is clear from the other cited portions of Halmann that the way scan conversion takes place is through input of coordinates to the lookup table, and that the coordinates of rays through the volume are just examples of such coordinates.

5. As to claim 11, applicant argues that a GPU is a term of art and that the mere fact that a processor processes graphics does not make said processor a GPU. Examiner notes that when examining claims, one must take the broadest reasonable definition of terms, consistent with the specification. Since the specification does not explicitly define the term "GPU", examiner must give the term its plain meaning, that

being a processor that processes graphics. In this instance, the processor of Halmann does meet this broad definition.

6. As to claim 15, applicant argues that Halmann does not disclose outputting interpolated polar coordinates from the lookup table. However, examiner notes that cited column 7 of the reference makes clear that polar coordinates are used in the lookup table, and cited columns 8 and 9 of the reference make clear that coordinates are interpolated. Taken together, the passages of the reference do disclose that such coordinates are interpolated from the lookup table.

7. As to claim 26, applicant argues that Halmann discloses volume rendering and coordinate transformation separately. However, examiner notes that column 5 of the reference clearly states that after a 3-d volume has been constructed, the Halmann invention processes and displays such information, which is described in more detail in previously cited column 7 of the reference.

8. As to claims 2 and 4, examiner's response to arguments above with regard to looking up polar coordinates and volume rendering also apply here.

9. As to claims 6 and 19, applicant argues that one would not have used the specialized alpha blending of Okerlund with the general programming approach of Halmann. However, applicant does not give any reason why the programmable CPUs of Halmann would not be compatible with the RGBA approach of Okerlund. Simply because the Halmann reference is directed to general CPU programming solutions does not disqualify a more advanced alpha-blending solution such as Okerlund from being used with it. Okerlund provides clear advantages such as more rapidly rendering

an image volume (col. 11, lines 8-10), which would have been noted by one skilled in the art looking to improve on the more simple invention of Halmann.

10. As to claims 9 and 22, applicant argues that Swerdloff does not disclose a table for conversion over multiple planes. Examiner notes that any change in the relationship between Cartesian and polar voxels causes another lookup table to be created in Swerdloff, and that, while not expressly disclosed by Swerdloff, another acquisition plane would be cause for such a relationship to change, and therefore the Swerdloff reference would generate another lookup table in such a situation.

11. As to claim 12, applicant argues that the values chosen by applicant are chosen to allow table based identification of data rather than scan conversion of data. However, applicant does not disclose why such values would be helpful in such a table, rather than using other values. Since there is no particular reason applicant gives for using the specific types of variables claimed, and since the types of variables are well known in the art, examiner must conclude that this a matter of design choice, where applicant has used a particular set of well-known variable types, but has not chosen them for any particular reason over other well-known variable types.

12. As to claims 13 and 25, applicant argues that Halmann discloses scan conversion of all data, and therefore a flag is not obvious. Examiner notes that Halmann does desire to scan convert all received data, but also notes that a flag when the end of data is reached (i.e. the next data is out-of-bounds) would still be obvious to anyone skilled in the art trying to implement a method wherein data exists within some boundary.

Claim Rejections - 35 USC § 102

13. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

14. Claims 1, 3, 5, 11, 14-16, 18, 24, and 26 are rejected under 35 U.S.C. 102(e) as being anticipated by Halmann (U.S. Patent 6,526,163).

15. As to claim 1, Halmann discloses a system for scan converting ultrasound data from an acquisition format to a display format, the system comprising:

a look-up table having values corresponding to a spatial conversion from the display format to the acquisition format (col. 7, lines 54-57; a number of scan conversion tables are generated);

and a processor operable to identify acquired ultrasound data as a function of the values and operable to interpolate display values from the identified acquired ultrasound data (col. 8, line 52-col. 9, line 4).

16. As to claim 3, Halmann discloses a system wherein the processor is operable to determine display coordinates of interest (col. 8, lines 4-9; an area of interest is defined and polar coordinates are defined from this area) and identify the acquired ultrasound data by inputting the display coordinates of interest into the look-up table (col. 7, lines col. 7, lines 54-57; col. 8, line 52-col. 9, line 4; the process of scan conversion finds

ultrasound data coordinates for display coordinates by converting from polar to Cartesian).

17. As to claim 5, Halmann discloses a system wherein the acquired ultrasound data represents a volume in the acquisition format, wherein the processor is operable to determine display coordinates for a plurality of rays through the volume as the display coordinates of interest (col. 5, lines 35-40; a volume rendering/raycasting module produces an image for display, which must include determination of display coordinates);

further comprising a display operable to display a two-dimensional image of a Volume Rendering of at least a portion of the volume in the display format with the display values (fig. 1, element 16; col. 5, lines 35-40).

18. As to claim 11, Halmann discloses a system wherein the processor comprises a graphics processing unit (col. 8, line 52-col. 9, line 4; Halmann discloses a number of CPUs set up for scan conversion; since this is a graphics operation, the CPUs read on graphic processing units).

19. As to claim 14, Halmann discloses a method for scan conversion of ultrasound data from an acquisition format to a display format, the method comprising:

(a) identifying acquisition format coordinates with display format coordinates indexed to a look-up table (col. 8, lines 3-9; col. 7, lines 54-57; polar coordinates are acquired and changed to display, or Cartesian, coordinates via a lookup table);

(b) interpolating acquisition format coordinates stored in the look-up table (col. 7, lines 54-57; col. 8, line 52-col. 9, line 4);

and (c) interpolating display values from acquired ultrasound data based on the acquisition format coordinates determined in (b) (col. 7, lines 54-57; col. 8, line 52-col. 9, line 4; interpolation takes place to map the acquisition, or polar coordinates, to display, or Cartesian coordinates).

20. As to claim 15, Halmann discloses a method wherein (a) comprises: (a1) inputting Cartesian coordinates into the look-up table; and (a2) outputting Polar coordinates interpolated from the look-up table in response to (a1) (col. 7, lines 54-57; col. 8, line 52-col. 9, line 4; the process of scan conversion involves a polar to Cartesian conversion via lookup table and interpolation).

21. As to claim 16, see the rejection to claim 3.

22. As to claim 18, see the rejection to claim 5.

23. As to claim 24, Halmann discloses generating the look-up table as a function of a spatial relationship of a display format with user configured acquisition parameters (col. 7, lines 54-59; tables generated are dependent on a selected mode of operation; col. 3, lines 59-62 states that this mode is determined by a user and col. 5, line 51-58 states that the mode determines acquisition parameters).

24. As to claim 26, Halmann discloses a system wherein (d) comprises generating a two-dimensional look-up table with acquisition format coordinates for each coordinate of a Cartesian volume (col. 7, lines 54-57; col. 8, line 52-col. 9, line 4; a lookup table for Cartesian coordinates would have to use at least x and y coordinates, inherently making it a 2-dimensional lookup table).

Claim Rejections - 35 USC § 103

25. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

26. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Zar ("A Scan Conversion Engine for Standard B-Mode Ultrasonic Imaging").

27. As to claim 2, Halmann discloses values comprising polar coordinates and lookup table entries indexed by Cartesian coordinates (col. 7, lines 54-57; col. 7, lines 54-57), but does not expressly disclose a processor operable to bilinearly interpolate from the look-up table values using fractional offsets of Cartesian coordinates. Zar, however, discloses a bilinear interpolation using fraction offsets of Cartesian coordinates (p. 1, Introduction) to be able to convert to polar using a lookup table (p. 2, LUTs and Constant LUTs sections). The motivation for using this system is to accomplish scan conversion at a very low cost (p. 1, Abstract). It would have been obvious to one skilled in the art to use bilinear interpolation and LUTs to convert polar to Cartesian coordinates in order to reduce cost as taught by Zar.

28. Claims 4 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Hossack (U.S. Patent 6,352,511).

29. As to claim 4, Halmann discloses a system wherein the acquired ultrasound data represents a volume in the acquisition format (col. 5, lines 35-40) and also a system comprising a display operable to display a two-dimensional image representing the plane in the display format with the display values (fig. 1, element 16). Halmann does

not disclose a system wherein the processor is operable to determine display coordinates for a plane through the volume as the display coordinates of interest. Hossack, however, discloses a system that allows for display of an arbitrary 2-dimensional plane through a 3-dimensional volume (col. 17, lines 4-11). The motivation for this is to allow the ultrasound image to better act as a diagnostic aid (col. 16, lines 50-57). It would have been obvious to one skilled in the art to modify Halmann to determine display coordinates for a plane through a volume in order to better diagnose a patient as taught by Hossack.

30. As to claim 17, see the rejection to claim 14. Hossack further discloses displaying a two-dimensional MPR image representing the plane in the display format as a function of the display values (col. 17, lines 4-11).

31. Claims 6 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Okerlund (U.S. Patent 6,690,371)

32. As to claim 6, Halmann does not disclose a system wherein each of the display values is a function of an alpha blending of a plurality of acquired ultrasound data values and wherein the processor is operable to limit a number of acquired ultrasound data values blended as a function of a threshold such that scan conversion of other acquired ultrasound data values is avoided. Okerlund, however, discloses alpha blending ultrasound data values (col. 7, lines 4-19; RGBA values are used to blend), and limiting the number of values blended to a "decimated" volume (fig, 13; col. 11, lines 8-35) with a threshold of less than a full volume. The motivation for this is to more rapidly render an image volume (col. 11, lines 8-10). It would have been obvious to one

skilled in the art to modify Halmann to use a threshold to ensure only some ultrasound data is blended in order to reduce time taken to display as taught by Okerlund.

33. As to claim 19, see the rejection to claim 6.

34. Claims 7 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Drebin (U.S. Patent 4,835,712).

35. As to claim 7, Halmann does not disclose a system comprising an RGBA look-up table addressed by the display values, the RGBA look-up table operable to output an RGBA value corresponding to the display value. Drebin, however, discloses a system that inputs monochrome display values to a lookup table and outputs RGBA values for those values (col. 7, lines 44-62). The motivation for this is to simulate an image illuminated by one or more sources of light (col. 2, lines 4-24). It would have been obvious to one skilled in the art to modify Halmann to use a lookup table to convert between display values and RGBA values in order to simulate an image illuminated by one or more sources of light as taught by Drebin.

36. As to claim 20, see the rejection to claim 7.

37. Claims 9 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Swerdloff (U.S. Patent 5,483,567).

38. As to claim 9, Halmann does not disclose a system wherein the look-up table values correspond to the spatial conversion from the display format to the acquisition format for at least one acquisition plane; further comprising an additional look-up table corresponding to spatial conversion from the display format to the acquisition format across multiple acquisition planes. Swerdloff, however, discloses a system wherein a

change in relationship between polar and Cartesian voxels, such as a change when changing an acquisition plane, necessitates creation of another lookup table (col. 9, lines 6-25). This is motivated by the fact that the current lookup table will no longer be accurate (col. 9, lines 19-25). It would have been obvious to one skilled in the art to modify Halmann to use an additional lookup table when multiple acquisition planes are used in order to have an accurate lookup table as taught by Swerdloff.

39. As to claim 22, see the rejection to claim 9.

40. Claims 12, 13, and 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann.

41. As to claim 12, Halmann does not disclose a system wherein the look-up table values each comprise a set of two fixed-point values, one Boolean Flag, and one Integer Sum, the two fixed-point values being Polar coordinates. These, however, are all arbitrary classes of variables and there is no disclosed criticality to them in applicant's specification. The choosing of these particular classes of variables appears to be a matter of design choice. One skilled in the art would expect the invention of Halmann to work equally well with various other types of variables, such as integers, floating point variables, etc.

42. As to claim 13, Halmann does not expressly disclose a system wherein a Boolean Flag indicates whether the set corresponds to a location outside of a scanned region. However, Official Notice has been taken of the fact that setting a variable for when data is in or out of a range is well-known in the art (see MPEP 2144.03). It would have been obvious to one skilled in the art to modify Halmann to set a variable when

data is out of range in order to communicate this error to other parts of a computing system.

43. As to claim 25, see the rejection to claim 13.

44. Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Halmann in view of Edic (U.S. Publication 2004/0136490).

45. As to claim 27, Halmann does not disclose a method further comprising: (d) Volume Rendering as a function of the display values as a function of time. Edic, however, discloses a method of volume rendering in which the motion of a volume over time is depicted (p. 4-5, section 0045). The motivation for this is to represent a cycle, such as a cardiac cycle (p. 4-5, section 0045). It would have been obvious to one skilled in the art to modify Halmann to volume render using display values as a function of time in order to represent a cardiac cycle as taught by Edic.

Conclusion

46. Claims 8, 10, 21, and 23 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

47. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the

shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to AARON M. RICHER whose telephone number is (571)272-7790. The examiner can normally be reached on weekdays from 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kee Tung can be reached on (571) 272-7794. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Kee M Tung/
Supervisory Patent Examiner, Art Unit 2628

AMR
6/21/08